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Short Note

Effect of different levels of initial infestation of *Callosobruchus chinensis* L. on progeny development and quality characters of stored pea (*Pisum sativum* L.) seeds

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Abstract

Effect of different pairs of *Callosobruchus chinensis* (L.) was studied on fecundity, progeny development, extent of seed damage, weight loss and seed germination in the Seed Technology and Production Centre of Dr. Y.S. Parmar University of Horticulture and Forestry , Nauni, Solan (Himachal Pradesh). Fecundity (143.0 eggs) , progeny development (23.50 adults), seed damage (4.53%) and weight loss(7.75 %) was maximum with 5 pairs of beetles of *C. chinensis* and minimum with 1 pair of beetles of *C. chinensis* while maximum seed germination (82.0 %) was recorded with 1 pair of beetles. Highly positive correlation was observed between different pairs of *C. chinensis* and progeny development, where as negative correlation was recorded with respect to seed germination. Positive correlation was also recorded between progeny development and seed damage, weight loss and negative correlation with seed germination.

Key words: *Callosobruchus chinensis,* fecundity, progeny development, seed damage, seed germination.

Pea (*Pisum sativum* L.) is a leading off-season vegetable crop of Himachal Pradesh. It is grown in area of about 17,365 hectares with an annual production of 2,03,415 metric tones (Anonymous 2008). One of the major constraints in realizing potential production level is the insect-pest infestation both in the field and in storage. A number of insect-pests have been observed to attack the stored grains having different patterns of behaviour and nutritional requirements. Insects often cause extensive damage to the stored grains and grain products, amounting to 5-10 per cent in the temperate and 20-30 per cent in the tropical zone (Nakakita, 1998). Among the important insect-pests of stored grain, the pulse beetle, *Callosobruchus chinensis* L. (Bruchidae: Coleoptera), causes substantial losses to the pulses in the storage (Alam, 1971; Singh *et al*., 2001 and Umrao and Verma, 2002) though the initial infestation occurs in the field itself. Gurjar and Yadav (1978) reported 55-60 per cent loss in seed weight and 45.50- 66.30 per cent loss in protein content by *C. chinensis* on chickpea seeds as a result of which seeds become unfit both for human consumption as well as for sowing purpose. It causes weight loss, decreased germination potential and reduction in commercial value of the seed (Booker, 1967). The present investigations were carried out to study the effect of different levels of infestation of *C. chinensis* on progeny development, loss in seed weight and effect on seed germination.

Studies were conducted in the laboratory of Seed Technology and Production Centre, of Dr. Y.S.Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, during 2008. Seeds of pea variety Arkel were heat sterilized at 55^0C for 4 hrs. in an oven as per method of Mookherjee *et al.* (1968). The pure culture of *Callosobruchus chinensis* was raised on heat sterilized pea seeds contained in half kg capacity plastic jars. Ten pairs of freshly emerged adults of *C. chinensis* were released in these jars. The jars were covered with muslin cloth and kept in BOD incubator maintained at 27 ± 1^0C and 70 ± 5 % relative humidity for their further multiplication. Different pairs of *C. chinensis* (1, 2, 3, 4 and 5) were released separately in each plastic container (250 cc capacity) provided with 100g sterilized seeds of pea. All containers were covered by muslin cloth and tightly secured with rubber band. There were five treatments with four replications. After one week of exposure of pea seeds to *C. chinensis* infestation, the number of grains with eggs and number of eggs deposited on these grains was counted. Seeds from each treatment were examined individually under the magnifying glass. Thereafter, the adult emergence was monitored at monthly interval for 2 months. Adults emerged were removed from the container at the time of counting. The per cent seed damage

was calculated by adopting the procedure given by Adams and Schulten (1978). Mean of four replications was taken to determine the per cent seed damage in each treatment. Initial weight and final weight of the grain was recorded and per cent weight loss was calculated as given below

$$\text{Per cent weight loss} = \frac{\text{Initial weight-Final weight}}{\text{Initial weight}} \times 100$$

The per cent seed germination was calculated by taking 100 seeds from each container. The seeds were sandwiched between towel paper as proposed by Sen and Ghosh (1999). The paper towel was then kept in seed germination chamber at 25 ± 1^{0}C. Four replications were maintained. The germination percentage was calculated as per the ISTA procedure (Anonymous, 1985). All the results were statistically analysed.

Data presented in Table 1 revealed that mean fecundity of different pairs (1 and 2 pairs) of C. *chinensis* was significant with 4 and 5 pairs as compared to rest of the treatments. After 60 days of treatment, the progeny development was maximum (23.50 adults) with 5 pairs of beetles and minimum (7.5 adults) with one pair of beetles. In rest of the treatments, progeny development was non significant. The seed damage differed significantly among different treatments. Minimum seed damage (0.93%) was recorded with 1 pair of beetles and maximum seed damage (4.53 %) with 5 pairs of beetles. The differences in seed damage did not exist with 1and 2 , 2 and 3 and 4 and 5 pairs of beetles. Seed damage recorded with 1 pair of beetle was significantly different when compared to rest of the pairs of the beetles excluding 2 pairs of beetles.

Loss in seed weight was low (2.37 %) with one pair and highest (7.75 %) with 5 pairs of beetles. The loss in seed weight from 1and 2, 2 and 3 and 4 and 5 pairs were statistically at par with each other. Loss in seed weight recorded with 1 to 3 pairs of beetles was significantly different with 4 and 5 pairs of beetles. The seed germination differed significantly among different treatments. Maximum seed germination (82 %) was recorded with 1 pair and minimum of seed germination (72.50 %) with 5 pairs of beetles. Seed germination (82 %) recorded with 1 pair of beetle was significantly different with all other pairs of beetles. A highly positive correlation (r=0.9635,0.9778, 0.9950 and 0.9815) existed between fecundity , progeny development , seed damage and weight loss and number of pairs of beetle of *C. chinensis*, respectively initially released and allowed to develop whereas negative correlation (-0.9317) was observed between number of pairs of beetles and seed germination (Table 2). Positive and significant correlation was observed between progeny development and seed damage and weight loss while negative correlation existed between progeny development and seed germination. These findings are in line with observations of Singal *et al.* (1996) who also studied the effect of different levels of *C. chinensis* on population build up, seed damage and reported high positive correlation between population build up and number of sexual pairs.

Table 1. Effect of different levels of initial infestation of C. *chinensis* on quality parameters of pea

Treatment	No. of eggs/ 5 female*	Adult emergence**	Seed damage*** (%)	Weight loss*** (%)	Germination*** (%)
T1	43.50 (6.51)	7.50 (2.71)	0.93 (5.36)	2.37 (8.85)	82.00 ((64.90)
T2	53.06 (6.94)	14.25 (3.89)	1.58 (7.18)	3.12 (10.04)	76.50 (61.01)
T3	87.00 (9.21)	15.25 (4.00)	2.41 (8.77)	4.37 (11.96)	75.50 (60.35)
T4	140.50 (11.60)	21.25 (4.68)	3.48 (10.32)	6.87 (15.14)	74.50 (59.68)
T5	143.00 (11.74)	23.50 (4.94)	4.53 (12.29)	7.75 (16.15)	72.50 (58.55)
Mean	93.40 (9.22)	16.35 (4.05)	2.59 (8.79)	4.89 (12.43)	76.20 (60.90)
CD (P=0.05)	(3.28)	(1.11)	(3.30)	(2.33)	(3.66)

*Figures in parentheses are √X transformations
** Figures in parentheses are log √X+1 transformations
*** Figures in parentheses are arc sine transformations

Table 2. Coefficient of correlation between *C. chinensis* infestation and different parameters of seed damage in pea

Parameters		Correlation coefficient
No. of pairs of beetles released		
Vs	Egg	0.9635
Vs	Progeny development	0.9778
Vs	Seed damage (%)	0.9950
Vs	Weight loss (%)	0.9815
Vs	Germination (%)	-0.9317
Progeny development		
Vs	Seed damage (%)	0.9661
Vs	Weight loss (%)	0.9623
Vs	Germination (%)	-0.9563

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